Lecture-7-

1. *Corynebacterium diphtheriae*
2. *Listeria*
3. *Bacillus anthracis*
4. **Propionibacterium acnes**

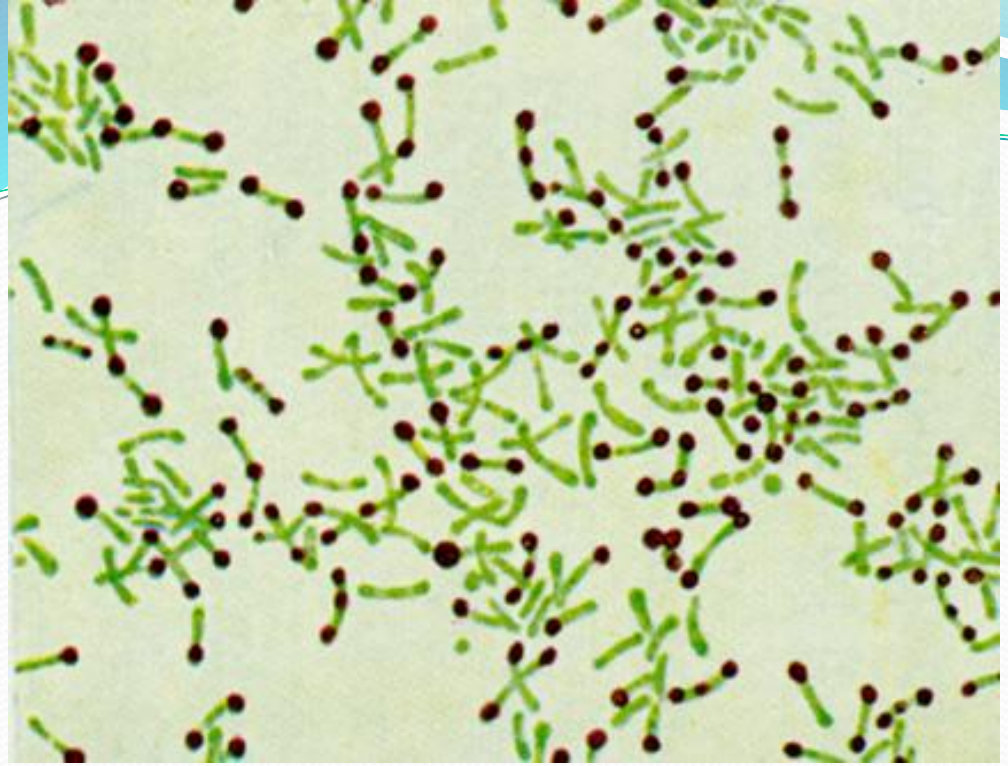
Prof. Dr.Nada Khazal K. Hindi

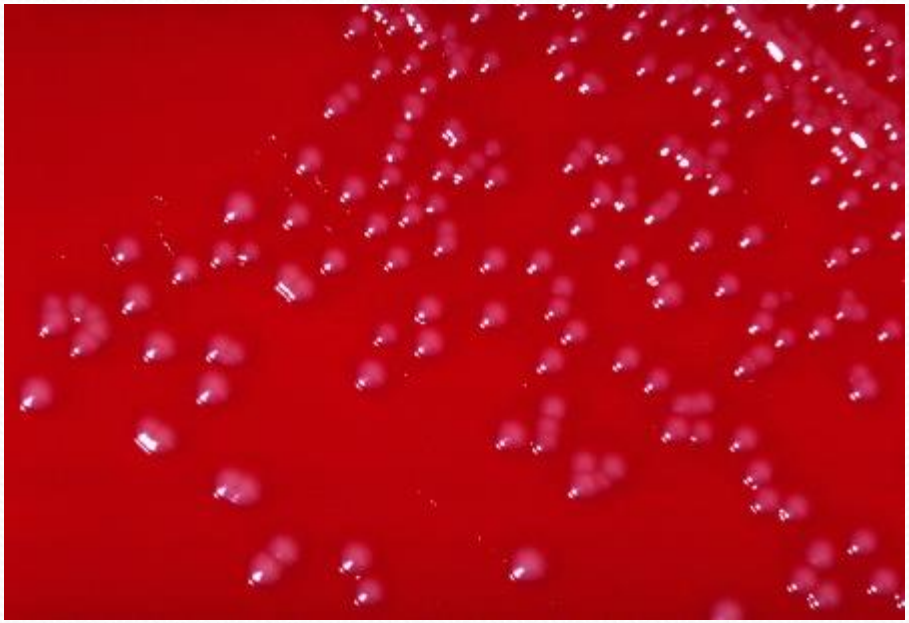
Corynebacterium diphtheriae

Corynebacteria are small, slender, pleomorphic, gram-positive rods& **Chinese letters**. They are non motile, un encapsulated, and do not form spores, **containing chromatin granules called volutin granules** or Babes- Ernest granules present in cytoplasm and aggregated in the poles of the cells (staining by Albert stain).

Pathogenesis:

Diphtheria is caused by the local and systemic effects of **a single exotoxin that inhibits eukaryotic protein synthesis.** Diphtheria, caused by *C. diphtheriae*, is an acute respiratory or cutaneous disease and may be a life-threatening illness, diphtheria is a serious disease throughout the world, particularly in those countries where the population has not been immunized.



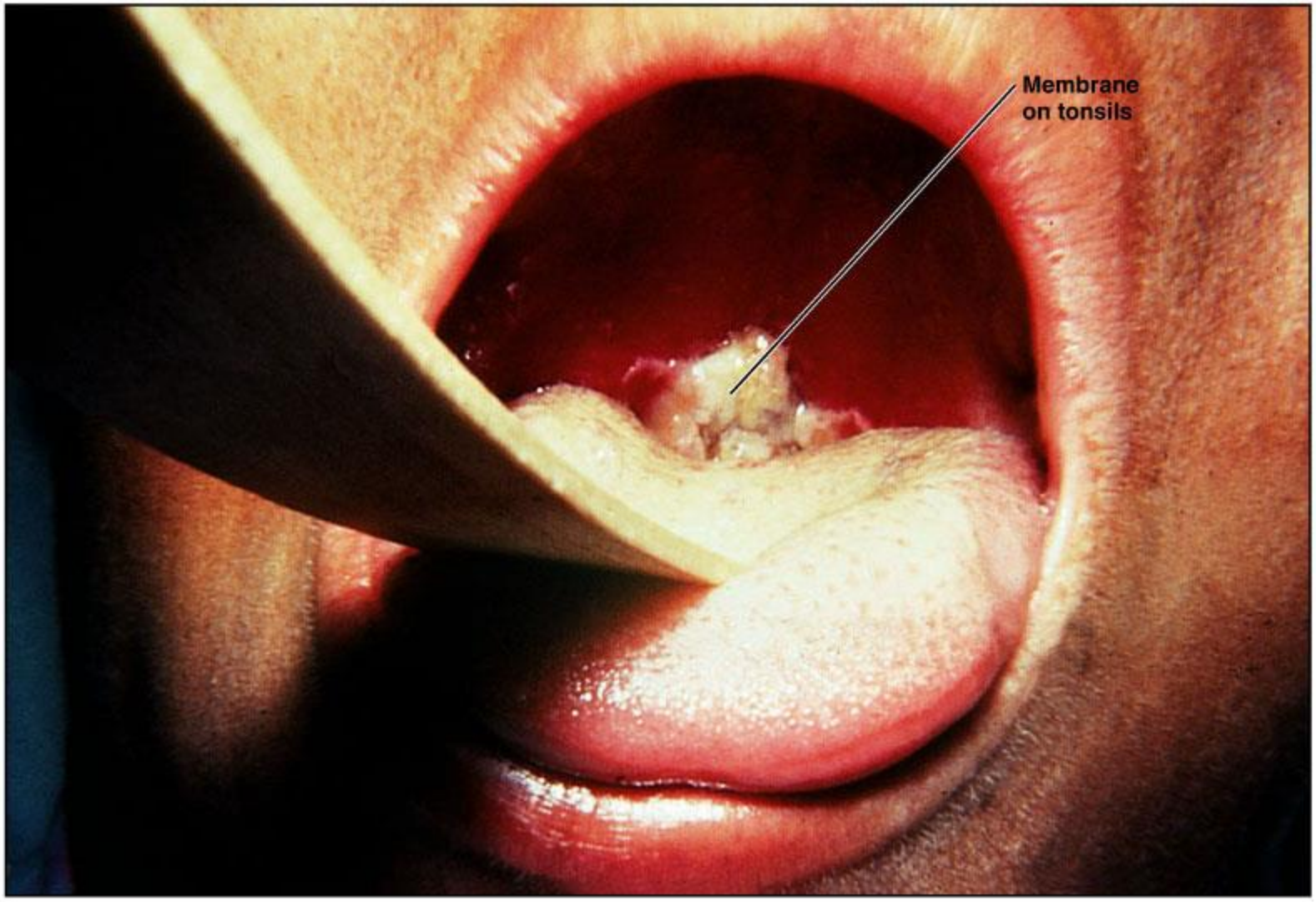


Clinical significance

Infection may result in clinical disease which has two forms respiratory and cutaneous or in an asymptomatic carrier state.

Upper respiratory tract infection: Diphtheria consists of a strictly local infection, usually of the throat. The infection produces a distinctive thick, grayish, adherent exudate (pseudomembrane) that is composed of cell debris from the mucosa and inflammatory products

Cutaneous diphtheria: A wound or cut in the skin can result in introduction of *C. diphtheriae* into the subcutaneous tissue, leading to a chronic, non healing ulcer with a gray membrane.



- **Laboratory identification**:

Gram-positive rods& Chinese letters. They are containing chromatin granules called volutin granules or present in cytoplasm and aggregated in the poles of the cells (staining by Albert stain). Most species are facultative anaerobes, grow aerobically on standard laboratory media such as Chocolate & blood agar

- **Prevention:**

diphtheria prevention is immunization with **toxoid,** usually administered in the **DPT triple vaccine** (diphtheria toxoid, tetanus toxoid and pertussis antigens). The initial series of injections should be started in infancy. Booster injections of diphtheria toxoid (with tetanus toxoid) should be given at approximately ten-year intervals throughout life. The control of an epidemic outbreak of diphtheria involves rigorous immunization and a search for healthy carriers among patient contacts.

Antibiotics: Early administration of specific antitoxin against the toxin formed by the organism. 20000-100000 units are injected intramuscularly or intravenously. **Antimicrobial drugs : penicillin, erythromycin** inhibit the growth of diphtheria bacilli . Antibiotics reduce to just a few days the length of time that a person with diphtheria is contagious.

Listeria monocytogenes

- *Listeria* species are slender, short, gram-positive rods. They do not form spores. Sometimes they occur as diplobacilli or in short chains. *Listeria* species are catalase-positive, and display a distinctive tumbling motility like umbrella on broth media. It has toxin called listeriolysin O. *L. monocytogenes* is the only species that infects humans.
- **Pathogenesis**

L. monocytogenes is intracellular parasite may be seen within host cells in (phagocytosis or macrophages). The organism attaches and enters of mammalian cells, by normal phagocytosis; once internalized, it escapes from the phagocytic vacuole by elaborating listeriolysin O (a membrane-damaging) & it produced phospholipases (membrane degrading) then mediate the passage of the organism directly to a neighboring cell, allowing avoidance of the immune system.

- **Clinical significance**

L. monocytogenes enters the body through the gastrointestinal tract after ingestion of contaminated foods such as cheese or vegetables . Listeriaosis – neonates Intrauterine infection may cause prematurity, early onset sepsis or granulomatosis infantiseptica can be: **Early-onset sepsis** (infection during pregnancy) **Late-onset sepsis** (infection at delivery, or later, hospital-acquired) Granulomatosis (cutaneous and visceral micro-abscesses), high mortality. Adults can develop listeria meningoencephalitis, Septicemia, bacteremia especially in immunosuppressed or immunocompromised patients

Listeria infections are most common in pregnant women, fetuses or newborns

ركزوا على اللون الاحمر

Laboratory identification

The organism can be isolated from blood, cerebrospinal fluid, On blood agar, L. monocytogenes produces a small colony surrounded by a narrow zone of hemolysis.

Treatment Ampicillin with erythromycin or with intravenous trimethoprim-sulphamethoxazole. .

Bacillus is spores forming

It is gram-positive rods, non motile, encapsulated, and facultative aerobes. **And spore forming** There 3 types: B. anthracis, B. subtilis, B. cereus.

Pathogenesis of B. anthracis

B. anthracis possesses a capsule that is antiphagocytic and is essential for full virulence. The organism also produces three exotoxins;

edema factor (EF) is responsible for the severe edema seen in B. anthracis infections;

lethal toxin (LT) is responsible for tissue necrosis;

protective antigen (PA) mediates cell entry of edema factor and lethal toxin

PA+EF+ LT = edema+ tissue necrosis

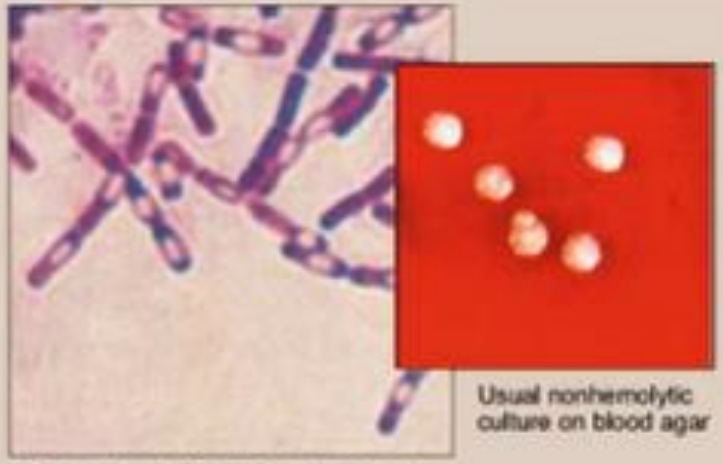
PA+ LT = tissue necrosis

PA+EF = edema

EF+ LT = No change

Gram (+) rods

Bacillus species



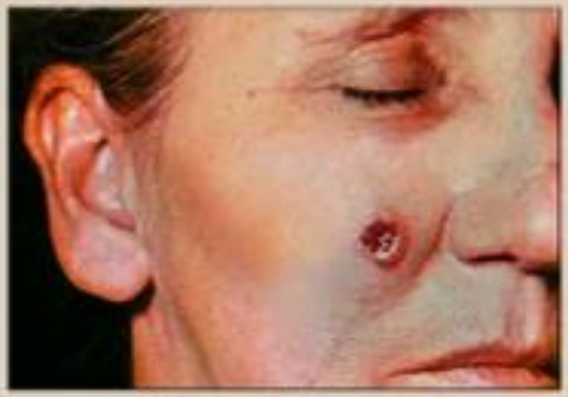
Usual nonhemolytic culture on blood agar

Gram stain of *Bacillus anthracis* culture smear showing typical bacilli with highly refractile unstained spores

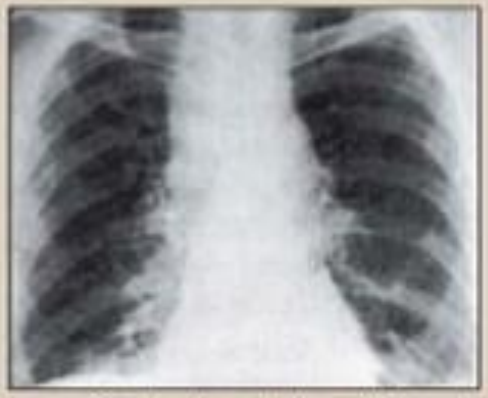
- **Gram-positive**
- Blunt-ended bacilli that occur singly, in pairs, or frequently, in long chains
- Form endospores—oval and centrally located
- Non-motile; have capsule that is antiphagocytic
- Facultative or strictly aerobic organisms
- Culture on blood agar

Bacillus anthracis

- Cutaneous anthrax
  - Tetracyclines → Doxycycline
  - Macrolides → Erythromycin
  - Fluoroquinolones → Ciprofloxacin
- Pulmonary anthrax (woolsorter's disease) Multidrug therapy (ciprofloxancin plus rifampin plus vancomycin) is recommended .



Cutaneous anthrax



Chest radiograph of a patient with pulmonary anthrax, showing widening of the mediastinum.

Clinical significance

1. **Cutaneous anthrax**: About 95% of human cases of anthrax are cutaneous. Upon introduction of organisms or spores that germinate, a papule develops. It rapidly evolves into a painless, black, severely swollen malignant pustule, which eventually crusts over. The organisms may invade regional lymph nodes and then the general circulation, leading to fatal septicemia. Although some cases remain localized and heal, the overall mortality in untreated cutaneous anthrax is 20%.
2. **Pulmonary anthrax** (wool sorter's disease) is caused by inhalation of spores. It is characterized by progressive hemorrhagic lymphadenitis (inflammation of the lymph nodes), and has a mortality rate approaching 100 percent if left untreated.
3. **Gastrointestinal anthrax (rare):** the infection is acquired by ingestion of contaminated meat

Laboratory identification:

B. anthracis is easily recovered from clinical materials. Microscopically, the organisms appear as blunt-ended bacilli that occur singly, in pairs, or frequently in long chains. They do not sporulate often in clinical samples, but do so in culture. The spores are oval and centrally located. On blood agar, the colonies are large, grayish, and nonhemolytic, with an irregular border.

Treatment:

Cutaneous anthrax responds to doxcycline, ciprofloxacin, or erythromycin. Multidrug therapy (ciprofloxacin + rifampin + vancomycin) is recommended for inhalation anthrax.

- **Vaccines**

للفهم

- (AVA BioThrax) In the United States, the current FDA-approved vaccine (AVA BioThrax) is made from the supernatant of a cell free culture of an encapsulated but toxigenic strain of B. anthracis.
- Raxibacumab is a human monoclonal antibody against Bacillus anthracis protective antigen PA

Bacillus cereus

- فقط الي باللون الاحمر
- **Produces emetic toxin and enterotoxins.**
- **Food poisoning** caused by B cereus has two distinct forms,
- Emetic type, which is associated with cooked rice.
- nausea, vomiting, abdominal cramps, and occasionally diarrhea
- Incubation period of 1–24 hours
- Other infections; Eye infections, Endocarditis, meningitis, osteomyelitis, and pneumonia.
- Treatment: Vancomycin or Clindamycin with or without an aminoglycoside

Bacillus subtilis, known also as the **hay bacillus** or **grass bacillus**, found in soil and the gastrointestinal tract of humans and ruminants, marine sponges

- **Propionibacterium acnes**

P. acnes are members of the normal microbiota of the skin, oral cavity, large intestine, conjunctiva, and external ear canal. They are anaerobic or aerotolerant nonmotile. Gram-positive bacillus arranged in short chains or clumps . Their metabolic products include propionic acid, from which the genus name derives. Propionibacterium acnes, often considered an opportunistic pathogen, causes the disease acne vulgaris in adolescents and young adults and is associated with a variety of inflammatory conditions. It causes acne by producing **lipases** that split free fatty acids from skin lipids. These fatty acids can produce tissue inflammation that contributes to acne formation. This bacterium also produce array of enzymes that contribute to pathogenesis: like proteases and hyaluronidase. P. acnes colonize follicles of sebaceous glands which stimulate host inflammatory response and lead to rupture of follicles

Treatment: 1.Topical cleansing agent like benzoyl peroxide.

2. Antibiotic: erythromycin, tetracycline and clindamycin.

Bacteria	Virulence factors	Actions
Staphylococcus aureus		
Streptococcus pyogenes		
Corynebacterium diphtheriae		
Listeria		
Bacillus anthracis		
Propionibacterium acnes		